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NEW TERMITOPHILOUS DIPTERA FROM THE NEOTROPICS

BY CHARLES H. SEEVERS[1]

The subfamily Metopininae of the Phoridae is comprised of many fully winged, free-living species of flies and a remarkable group of species whose apterous or brachypterous females are in the majority of cases inquilines in the nests of social insects. Most of these females show other morphological modifications in addition to the reduction or loss of wings and halteres. The sclerotization of the abdomen is usually very weak; the sterna are unsclerotized in most of the species and the terga are frequently unsclerotized or are very small. The abdomen, which may also be somewhat swollen, thus presents a wide expanse of membranous integument, and in some genera special integumentary glands are present on the dorsum. The eyes are greatly reduced in some species and the members of one genus are without external vestiges of eyes. The males of this group of phorids are unmodified.

The species with which this paper is concerned were collected from termite colonies on Barro Colorado Island, Canal Zone, by Dr. Alfred E. Emerson and at Villavicencio, Meta, Colombia, by the writer. In no instance were the winged males collected, since they do not reside permanently, if at all, in the nests. The following new species are described: *Syntermophora microphthalma*, *Cryptophora colombiae*, *Ecitomyia termitoxena*, *Homalophora guatiquiae*, *Homalophora metae*, and *Puliciphora termitophila*. The termites with which these beetles were associated were identified by Dr. Emerson, to whom the writer is greatly indebted.

Cryptophora colombiae and *Syntermophora microphthalma* were collected in Colombia from a colony of *Syntermes molestus* Burmeister, in which the royal cell with the king and strongly physogastric queen was on the surface of the ground beneath a log. The eyeless and apterous females of *C. colombiae* were riding about on the backs of the worker termites while the apterous and nearly eyeless females of *S. microphthalma* were running rapidly about among the termites. *Cryptophora* was hitherto represented by a single species (*C. coeca* Borgmeier, 1935, p. 488) collected from a marching colony of *Syntermes* sp. at Santa Cruz, Goyaz, Brazil. As Borgmeier points out, blindness is extremely rare among Diptera and was previously unknown in the Phoridae.

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The new species of *Ecitomyia* was taken from the galleries of an earthen mound nest of *Anoplotermes* sp. in Colombia. This is the first species of the genus to have been found associated with termites; the other four myrmecophilous species occur with several genera of ants (*Eciton, Pheidole, Solenopsis*) from Texas to Brazil. Two other new Colombian species of phorids, which were taken from large carton nests of *Nasutitermes ephratae* Holmgren, apparently belong to the genus *Homalophora* Borgmeier. One termitophilous Brazilian species and one attaphilous Cuban species have been described. *Ecitomyia* and *Homalophora* are unusual genera in being comprised of both myrmecophilous and termitophilous species.

Puliciphora termitophila, collected from the carton nest of *Nasutitermes ephratae* Holmgren on Barro Colorado Island, is a new species of a large and widely distributed genus. The genus is especially interesting since it appears to be unique in that it is made up of termitophilous, myrmecophilous, and free-living species, which, regardless of the ecological niche in which the female occurs, are morphologically similar (except for specific differences). Of the thirty-five described species of this genus, eight are known only from males, while the remaining twenty-seven species have been described from female specimens or, in some instances, from both sexes. In only eight of the twenty-seven cases where the females were collected were they discovered in the nests of the social insects; six were taken with termites in India, Belgian Congo, Brazil, and Panama, and two Mexican species were collected from the nests of ants. Females of nineteen species of the genus have been collected from dead animals, carrion-scented flowers (*Amorphophallus*), and decaying vegetable material; they were apparently attracted to these substances to oviposit. The following examples will illustrate the ecological situations in which some of the free-living species were discovered: *P. beckeri* de Meijere (Java) was bred from decaying meat; *P. borinquenensis* Wheeler (Puerto Rico, Bahamas, Guatemala) was attracted to decaying insects and mollusks; *P. ossuaria* Schmitz (Brazil) was taken from a bone; *P. africana* Brues (Africa) was bred from rotting stems of pawpaw trees; *P. occidentalis* Melander and Brues was collected in the vicinity of an *Halictus pruinosis*

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burrow at Woods Hole, Massachusetts, and on mollusk shells received from Nassau, Bahama Islands.

A study of these brachypterous and apterous Phoridae brings to one's attention a number of interesting biological problems. Since the data concerning the physiology and ecology of the group are very limited at present, the answers are largely a matter of conjecture. The discussions of some of these problems which are presented here are intended primarily to stimulate investigation rather than to draw any conclusions.

It is of fundamental importance to determine whether or not these apterous females are physogastric, since a great deal depends on establishing this point. A comparative morphological study of the adaptations of symphilous termitophiles and myrmecophiles, exclusive of the Phoridae, reveals that physogastry is associated with the former and the presence of trichomes (glandular hairs) almost always with the latter, for example, Staphylinidae. Among the apterous and subapterous species of the Metopininae, myrmecophily seems to predominate, since there have been approximately sixty-six described myrmecophilous species (twenty-three genera), seventeen termitophilous species (nine genera), forty free-living species (five genera) collected from decaying organic matter, and three ectoparasitic species (one genus) associated with African snails. While it is not likely that all of these species are physogastric—the nineteen described species of *Chonocephalus* Wandolleck in which the females are known are free-living and have rather heavily sclerotized abdomens—some of them may well be. If the myrmecophilous species are physogastric, and most of them do have moderately inflated, membranous abdomens suggestive of it, the situation is very unusual. Furthermore, should the species of the aforementioned genus *Puliciphora* be found to be physogastric, a unique condition would be revealed since no other known physogastric insects are free-living.

Physogastry, which is so typical of termites and their guests, results, at least in many instances, from hypertrophy of the fat body and reproductive organs, increase of blood tissue, and greater development of integumental glands. The abdominal sclerites are, as a rule, widely separated and a large area of membranous integument is exposed. The physogastric termites, staphylinid beetles, termitoxenid flies, and other guests, secrete fatty substances through this membranous surface from which it is licked by other individuals of the society. While it has never been demonstrated that the phorid flies produce such an exudate, the wide expanse of membranous integument leads one to suspect such a function. In many of these phorids, special integumental glands have been discovered on the dorsum of the abdomen, usually associated with the fifth tergum, for example, *Ecitomyia* Brues, *Acontistoptera* Brues. The crescentic slit in the fifth tergum of *Puliciphora* was shown by De Meijere (1912, p. 141) to be the opening of a hypodermal gland located beneath the tergum. No satisfactory explanation of the function of these glands has been given and there is no evidence that the hosts react to an exudate from it. Schmitz (1913, p. 16) did not regard the termitophilous Indian species, *P. velocipes* Schmitz, as physogastric after studying sections of the abdomen, for he found that the swollen condition of the abdomen was due to a large, sucking stomach rather than to hypertrophy of fat body or reproductive organs. It seems to the writer, however, that the reason for the enlargement is unimportant, if it can be shown that a socially important exudate is secreted by the abdomen. The production of an exudate is an adaptation for acquiring social adjustment and it seems as if the term "physogastric" should be restricted to those social insects which secrete such substances from a somewhat swollen, more or less membranous, abdomen. There is still considerable question as to the physiology of exudate production by termitophilous insects. Wasmann and Holmgren advanced the idea that the fatty tissue of the abdomen is the source of the secretion, and this theory was further expanded by Wheeler. These writers suggested that the secretions are released into the blood by which they are carried to the hypodermis where they filter through the chitinous cuticle directly or by way of minute pores. This method of exudation has never been demonstrated but remains a distinct possibility (see McIndoo, 1923), even though Grassé and Lesperon (1938, p. 463) have discounted the idea on the basis of having demonstrated cutaneous glands and special open, gland hairs (adenotrichs) which presumably are responsible for the production of the secretion in the termitophilous beetle larva, *Troctontus silvestrii* Grassé and Lesperon. It seems likely that hypodermal glands will be found to be the source of the exudates in many termitophilous insects, although there may be other mechanisms of exudate production. The physiology of secretion by the social insect guests needs investigation.

The following discussion is intended to raise questions which must be answered should these flies prove to be physogastric, and is, therefore, more or less based on the assumption that they are. On the basis of morphological structure, it seems probable that the inquiline phorids are symphiles that live unmolested in the nests of termites and ants by virtue of the exudates to which the hosts react favorably because of olfactory or gustatory stimuli. One must not overlook, however, the possibility that the security of the flies is due to their great agility in eluding the mandibles of the termites, since they move about the galleries with great rapidity. If the latter possibility should prove true, the comparison of the abdomen with that of other termitophiles would be entirely misleading, and the modifications of the abdomen must be regarded as non-adaptive.

While it is not difficult to conceive of these flies as being adapted to the termite social system, it is puzzling to note that a number of species of *Puliciphora* are apparently not associated with social insects at all but are independently existing species. The situation becomes more enigmatic when it is recalled that both free-living and guest species show the same "adaptive" features. There is a possibility that intensive collecting in the regions where the free-living species occur might reveal that they also live in the nests of social insects, and that they leave the nests only on occasions. While this may be true in a few instances, it seems only remotely possible that all nineteen free-living species of *Puliciphora* would behave in this manner.

What possible course could evolution have taken to bring about a large genus in which some species are inhabitants of termite and ant colonies while others are not, even though they all seem to possess adaptations for a social life? The following alternatives are suggested as possibilities: (1) That the principal modifications of the females evolved outside the colonies of social insects, and that from time to time individuals invaded the termite nests, became established, and speciated; (2) that the adaptations of the females evolved within the colonies of social insects, and that from time to time individuals left the nest, oviposited in decaying material, and became established outside the colony, where speciation, due primarily to isolation, occurred; (3) that the evolution of these characteristics occurred independently within the colony and external to it. In the absence of direct evidence in favor of any of these alternatives, one must rely largely on speculation.

The following point seems to favor the first alternative in that it tends to make the second unlikely. Although comparatively little is known concerning the extent of distribution of the inquiline species, there does not appear to be enough material to account for the evolution of the free-living species from this stock. We must, however, take into account that the greater number of described free-living species is due, in part at least, to disproportionate collecting, since the termite nests of many tropical regions have been neglected. Even experienced collectors may overlook these flies, since their small size and rapid movements make them very elusive and since they disappear from view almost as soon as the termite nest is opened. Careful collecting will reveal many more inquiline species and may raise the number to a parity with the free-living species. Even so, it seems somewhat unreasonable to believe that free-living forms could have speciated from inquiline species except after numerous emigrations from the nest in various parts of the world. It is this recurrence of emigrations from the nest that would be difficult to account for, since it seems unlikely that organisms so well integrated in a social system as the termitophiles seem to be, would emigrate from the colony and become established elsewhere very frequently. The widely distributed non-inquiline species would have had to arise from inquiline species innumerable times, unless the distribution and subsequent speciation was very great after only a few emigrations in the different continental areas of the world.

If it should be proved that the inquiline species were derived from stock which had already become modified outside of the nest, it may be that this is a case of preadaptation comparable to that which Hubbs (1938, p. 261) postulates for the evolution of cave-fishes. He notes that, in general, cave-fishes are related to forms which appear to be preadapted to a life in complete darkness, since they have nocturnal burrowing or crevice-seeking habits and possess well-developed tactile and other senses. The catfishes, many of which show varying degrees of loss of eyes and pigment, have nocturnal habits and well-developed barbels, seem to be especially well adapted as precursors of cave-fishes and evidently were ancestral to many of the present-day cave-dwellers.

It seems, however, to be much more difficult to conceive of preadaptation for entrance into a social system. The environmental conditions in which the preadapted fishes live are not markedly different from those of the cave in which the evolved forms live; the differences are largely a matter of degree. On the other hand, the differences between the environment of the termite nest and that of the various niches outside the nest are much greater. It is quite true that one may point to a number of ecological situations such as decaying logs or humus of the forest floor, in which the physical factors may approximate those of the termite nest, but there is no situation where the biotic factors are comparable. It hardly seems as if it would require any special morphological adaptation to meet the physical conditions of the nest, but it must require at least some adaptation to cope successfully with the biotic factors peculiar to the termite colony. The morphological and physiological modifications of the termitophilous species are those which enable them to become an integral part of the social system, and situations where an animal could become preadapted for this life are somewhat difficult to visualize.

Hubbs points out that there is no reason to believe that the preadaptation of the fishes was complete, since totally blind and unpigmented forms are not known among those he considers to be preadapted for permanent occupation of caves. In the genus *Puliciphora* there are no apparent morphological differences between the inquilinous and free-living species, so it would almost be necessary to assume that preadaptation of the free-living species is virtually complete.

Aside from the genus *Puliciphora* there do not appear to be other cases where free-living species could possibly be regarded as preadapted for termitophily or myrmecophily; unless one wishes to regard the recurrence of termitophily within the same subfamily or tribe, for example, Aleocharinae—as evidenced by the occurrence of independently evolved groups of physogastric genera—as an indication of some less evident preadaptation. There is very frequently adequate material in the nest from which the true guests may be derived, since many of the permanent residents (synoeketes, synecthrans) of termite and ant nests are indistinguishable, as far as special morphological adaptations are concerned, from free-living related species. These species, which are persecuted by the hosts or are merely tolerated, undoubtedly form excellent stock for the derivation of the morphologically modified species. So, in most groups of termitophiles, we do not need to look for preadapted stock from which the symphilous species may be evolved. The situation in caves seems to be different, for, as Hubbs points out, while strays of free-living species of fishes are not infrequently found in caves, there is little ground for supposing that they have become modified into cave-fishes since they are hardly common enough to form a breeding stock and hardly permanent enough to allow for requisite mutation and evolution.

Despite these difficulties, should the free-living species of *Puliciphora* prove to be preadapted for social life, it would be remarkable, since it would be very difficult to account for the origin of physogastry (assuming that they are physogastric) outside of the nest. It is quite plausible, in the case of the inquilines, to attribute adaptive features, such as development of physogastry and integumental glands, to natural selection, since these are modifications that tend to gain for them colony recognition and would almost certainly have selective value. Among non-inquiline forms, however, it is not clear how these characters could have selective value. Reduction and loss of wings, halteres, and eyes are not as difficult to account for since they may well be non-adaptive changes which are likely to occur in the absence of selection, either for or against them, when mutation pressure is in that direction. Additional factors are, of course, important in the evolution of non-adaptive vestigial structures; one of the most significant of these is the multiple effects of genes. Since genes exert effects on many characters, the genes or gene combinations influencing degenerative changes may well be selected for their beneficial effects on the organism (for discussions of degenerative evolution, see Wright, 1929, 1934; Darlington, 1936; Emerson, 1938). The distribution of these flies seems scarcely to have been impaired by aptery—consider the wide range of some of the genera.

The following account of termitophily in the genus *Diploneura* seems to indicate a very different trend from that proposed in the first alternative in the case of *Puliciphora*. In this instance, if the meager data can be regarded as significant, the major evolutionary changes appear to have occurred in the nest. *Diploneura* is a large genus of the subfamily Phorinae in which the females and males are for the most part typical, free-living, winged phorids. There are, however, several species of the genus (subgenus *Dohrniphora*) from widely separated localities (ten Brazilian, three Indian, three Australian, and one African species), which are recorded as having been collected in or very near termite nests. These species do not differ in any appreciable respect from the non-termitophilous species, except in a few instances. It seems that a majority of the imagos of these termitophilous species are primarily free-living and enter the nests only at certain times. Borgmeier (1925, p. 91) states that the females of some of the Brazilian species enter the nests in order to oviposit. Presumably, it is in reality the larvae of these species which are termitophilous; there is no reason to believe that they are parasitic on the termites.

There are cases in this genus in which the females have apparently become permanent residents of the nest, for, according to Schmitz (1929, p. 108), the females of *Diploneura schmitzi* Kohl of Belgian Congo live permanently in the carton nest of termites. Recently, Fuller and Lee (1938, p. 75) discovered the apterous females and larvae of a species (*Diploneura gynaptera* Fuller and

Lee) in the mounds of *Nasutitermes* (=*Eutermes*) *exitiosus* Hill in Australia. It seems evident in this case that the females and larvae are regular inhabitants of the colony, and that the larvae are not parasitic.

If any inference may be drawn from these few cases, it is that the initial stage in the evolution of termitophily in this genus is the adaptation of the larva to the social life of the colony, the winged females entering the nests only to oviposit. In time, presumably, some of the females become adjusted to the social life even though at first they may not show any gross morphological adaptations. The completion of the adaptation of the female by the development of physogastry and other characteristics is not very difficult to account for. The fact that in only relatively few cases has this evolution progressed very far in this genus suggests a recent invasion of the nests by them.

In conclusion, the writer wishes again to emphasize that the data concerning these apterous flies are too limited to warrant more than the suggestion of problems to be answered. The status of the inquiline Phoridae in the termite and ant societies is a mystery, which can be solved only by careful observations upon living colonies.

Syntermophora gen. nov.

Type of the genus.—*Syntermophora microphthalma* sp. nov.

Description.—Head broadly triangular, all angles rounded. Head bearing four postantennal bristles and an occipital row of six setae. Ocelli absent. Eyes very small, composed of from four to six ommatidia. Proboscis short and thin, bifid. Palpi moderately broad, spatulate, setose. Antenna of usual form, arista approximately three times the length of the globose third segment, plumose. Head, thorax and terga rather densely clothed with fine hairs.

Thorax rectangular, more than twice as wide as long, bearing only a few pairs of setae. Apterous and halterless. Abdomen very broad, strongly compressed dorso-ventrally. Dorsum of abdomen having four terga rather heavily sclerotized; these terga rather broad, slightly deflexed at the sides. Fifth and sixth abdominal segments largely membranous, the fifth with narrow sclerotized strips on the dorsum. Sterna unsclerotized.

Legs of usual type, densely pilose; middle and hind tibiae bearing terminal spurs and several short setae; tarsi with usual hair seams; the metatarsal segment of the hind tarsi with six transverse rows of setae.

Syntermophora microphthalma sp. nov. (fig. 19, *a* and *b*)

Type from Villavicencio, Colombia. In the collection of Field Museum of Natural History. A female. Collected July 16, 1938, by Charles H. Seevers.

Paratype.—A female, same data as the type, in the collection of Charles H. Seevers.

Host.—*Syntermes molestus* Burmeister. Determined by Alfred E. Emerson.

Description.—Body for the most part testaceous; head with a V-shaped, median, brown area from base to apex; terga dark brown. Head broadly triangular, all angles broadly rounded, wider than long (11:7), posterior border broadly but not strongly arcuate. The rounded front bearing four postantennal bristles, the anterior pair proclinate, the posterior pair inserted farther apart so that they are also on the margin of the front. The posterior border bearing six setae; the middle one of the three on each side closer to the outermost bristle, which is the longest and coarsest of the series. Head rather densely clothed with short, moderately coarse hairs. Palpi bearing three strong, anteriorly directed setae, and a number of finer setae. The very small eyes are situated in a membranous area between the dorsum and the genae at the posterior edge of the membranous antennal fossa. Genae with a row of anteriorly directed bristles on the upper border, ten to twelve setae on the anterior border, and scattered smaller hairs.

Thorax wider than long (11:5), slightly wider basally. Thorax evenly and rather densely pubescent. Chaetotaxy as follows: A propleural bristle on each side; a pair of ventrally directed setae near the ventral tip of the propleurae on each side; a pair of erect setae near each posterior angle, the outer one longer; and a posteriorly directed mesopleural bristle at the usual wing site.

Abdomen much flattened, with four dark brown, broad terga. Terga approximately equal in width; the first, third, and fourth subequal in length, the second tergum one-half longer than the others. Terga clothed with many long, fine, recumbent hairs, those on the posterior border longer but little coarser than the others. Dorsal membranous surface of segments five and six rather densely clothed with hairs set in narrow chitinous rings. Ventral surface of abdomen very sparsely setose. Segments beyond the sixth telescoped in the specimens examined.

Measurement.—Length 1 mm.

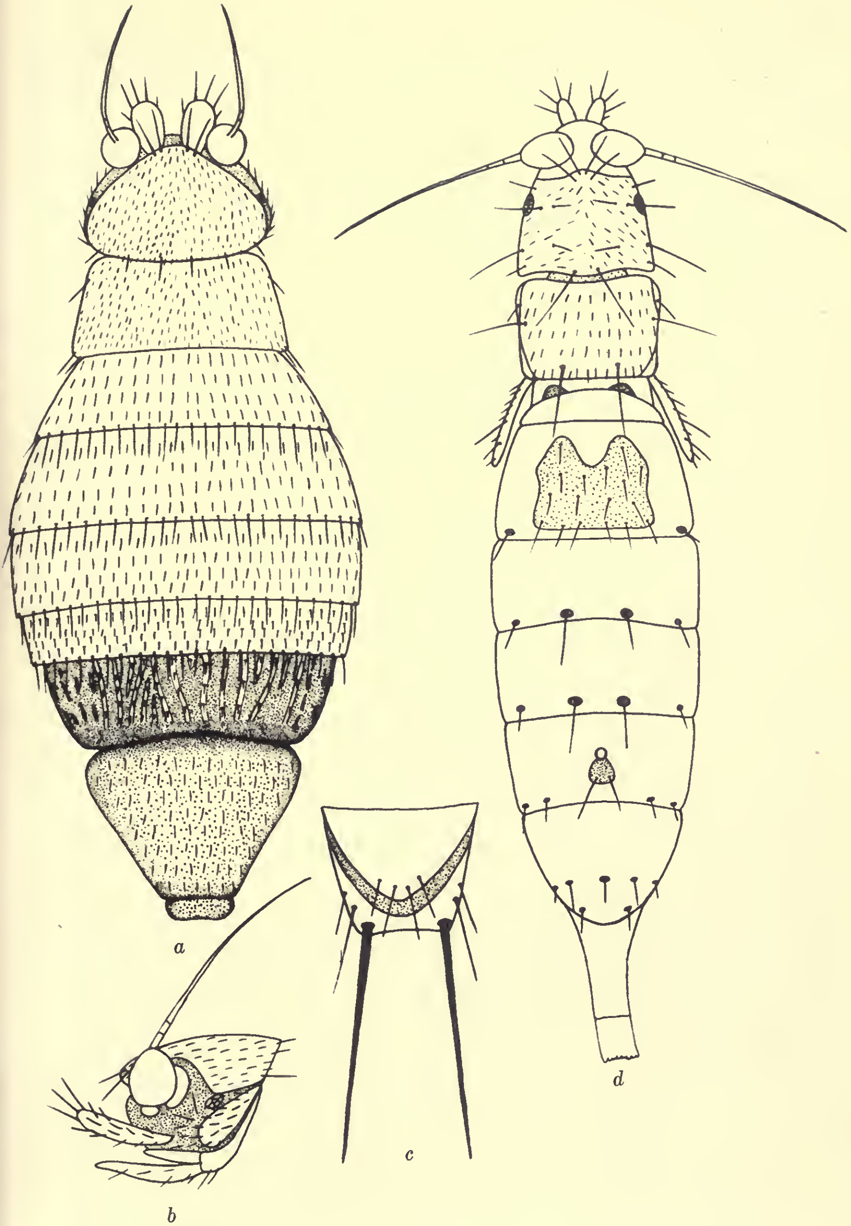

FIG. 19. a, *Syntermophora microphthalma* sp. nov.; dorsal view (membranous areas of abdomen stippled). b, *S. microphthalma* sp. nov.; lateral view of head. c, *Cryptophora colombiae* sp. nov.; fifth tergum. d, *Ecitomyia termitoxena* sp. nov.; dorsal view (sclerotized areas of abdomen stippled; most of abdominal tube omitted).

Cryptophora colombiae sp. nov. (fig. 19, *c*)

Type from Villavicencio, Colombia. In the collection of Field Museum of Natural History. A female. Collected July 16, 1938, by Charles H. Seevers.

Paratypes.—Seven females, same data as the type, three in the collection of Field Museum of Natural History and four in the collection of Charles H. Seevers.

Host.—*Syntermes molestus* Burmeister. Determined by Alfred E. Emerson.

Description.—Head yellowish; the area about the postantennal bristles brown except for a light yellow medial groove which extends on the dusky vertex; the occiput brown especially about the bases of the setae. Postantennal bristles stout, approximately equidistant from one another, the posterior pair distinctly longer; a pair of short, erect setae in the center of this postantennal group. Occipital border bearing three setae on each side, the middle one much the longest; vertex with scattered hairs. Eyes and ocelli absent. Pilosity of the sides of the head very similar to that figured by Borgmeier for *C. coeca*. Palpi with five or six macrochaetae and several finer hairs.

Thorax brown, pleura lighter in color. Pilosity of the thorax as in *coeca*. Thorax convex, broader than long, anterior border rounded, posterior border slightly concave. Abdomen oval, with five terga sclerotized in part. The small, sclerotized fifth tergum (fig. 19, *c*) with a crescentic gland opening is distinctive in form.

Measurement.—Length 1 mm. (1.5 mm. including abdominal tube).

Remarks.—This species is very closely allied to *C. coeca* Borgmeier (1935, p. 488), from which it appears to differ in the form of the fifth tergum and in the pilosity of the palpi.

Ecitomyia termitoxena sp. nov. (fig. 19, *d*)

Type from Villavicencio, Colombia. In the collection of Field Museum of Natural History. A female. Collected July 9, 1938, by Charles H. Seevers.

Paratypes.—Six females, same data as the type, three in the collection of Field Museum of Natural History, and three in the collection of Charles H. Seevers.

Host.—*Anoplotermes* sp. Since only the worker caste was collected, it is not possible to determine the species.

Description.—Head nearly rectangular, a little wider than long; sides nearly parallel, converging somewhat anteriorly; posterior border slightly sinuate laterally. Head light brown except for an irregular, light yellow area medially. Chaetotaxy of the head (fig. 19, *d*) as follows: Two pairs of stout postantennal bristles, the posterior pair slightly farther apart; one preocular bristle on each side; and three transverse rows of four setae each. The first of these rows comprised of a pair of setae medial to each eye, one being directed medially, the other, longer and stouter, being directed laterally. The second row of four a short distance in front of the occipital border, the outermost bristles of this series much longer and stouter than the inner ones. The inner pair of the third (occipital) row much stouter than the fine pair at the posterior angles of the head. Genae with a number of fine yellow hairs. Ocelli absent. Eyes small, composed of from eight to ten facets.

Thorax as wide as the head, rectangular, a little wider than long, sides nearly parallel. Thorax dusky yellow. Wings reduced to small rod-like structures a little shorter than the notum and weakly setose. Chaetotaxy of the thorax as follows: Two widely separated, rather long, semi-erect setae on the posterior border; one weak propleural seta on each side, one much longer seta a short distance posterior to it on the border of the pronotum. Thorax and head finely pubescent.

Abdomen ovoid, largely membranous since the sclerotized areas are very small. Abdominal segmentation is indicated very faintly. First tergum unsclerotized; second rectangular, much narrower than usual, feebly sclerotized in front, anterior border emarginate; the sclerotization of the third and fourth terga is limited to two small areas about setigerous punctures. The sclerotization of the fifth tergum is represented by a small, trapezoidal area caudad to a circular, chitinous-rimmed gland opening. Sixth tergum and the sterna unsclerotized. The tergum of the second segment bears fourteen to sixteen setae (of which six are in a posterior row), and the fifth bears a pair of moderately strong setae.

The membranous parts of the abdomen sparsely setose, the second and third segments bearing one seta on each side, the fourth and fifth with two on each side, and the sixth segment bearing two irregular rows of setae encircling the abdomen (with approximately ten setae in each circle) and with a short third row (of four, usually) cephalad to the other rows on the ventral side. Venter also bearing a few setae (usually two or three) on the fourth and fifth segments.

Abdominal segments beyond the sixth much more slender, forming a long tube, each segment of the tube with a circlet of fine setae near the terminal border.

Legs similar to those of *wheeleri*. Hind metatarsus with five transverse rows of setae on the plantar surface.

Measurements.—Length 1 mm. (1.5 mm. with abdominal tube extended).

Remarks.—The four described species of this genus are myrmecophiles: *E. wheeleri* Brues (1901, p. 347) occurs with *Eciton coecum* Latreille and *Eciton schmitti* Emery in Texas, *E. manni* Brues (1925, p. 303) with *Pheidole* sp. in Costa Rica, *E. minuscula* Borgmeier and Schmitz (1923, p. 137) with *Solenopsis saevissima* Smeathman and *E. luteola* Borgmeier and Schmitz (1923, p. 139) with *Solenopsis saevissima picea* Wasmann in Brazil.

E. termitoxena differs from these other species in the pilosity of the head, the very weak sclerotization of the third and fourth terga, and the presence of setae on the membranous portions of the abdomen. The small eyes also serve to distinguish this species from *luteola*, the eyes of which are larger than the globose third antennal segment.

Homalophora guatiquiae sp. nov.

Type from Villavicencio, Colombia. In the collection of Field Museum of Natural History. A female. Collected July 11, 1938, by Charles H. Seevers.

Host.—*Nasutitermes* (*N.*) *ephratae* Holmgren. Determined by Alfred E. Emerson.

Description.—Head and abdomen brown, terga dark brown; thorax, mouth parts and legs testaceous. Head with four erect postantennal bristles approximately equal in length, the posterior pair about as far apart as the anterior ones. Head bearing two stout preocular bristles and four setae along the occipital border. The medial pair of this row closely approximated between the posterior ocelli; outer, weaker ones at the posterior angles, a short distance behind the eyes. Dorsum of head moderately clothed with coarse, semierect hairs. Posterior border of the genae bearing a row of small setae.

Eyes elliptical, large, occupying most of the side of the head, setose. Antennal pits deep, extending very close to the median borders of the eyes. Antennae moderate in size, the globose third segment smaller than the eye; the arista long, plumose, about four times as long as the third segment. Palpi slender, bearing six long, moderately stout setae. Proboscis rather thick, about as long as the head. Ocelli large, forming a triangle enclosing a darker area.

Notum a little more than twice as wide as long, slightly convex, bearing a row of six bristles a short distance behind the middle, the medial two of which are rather close together. The middle seta of the three on each side is twice as far from the median seta as the distance between the median pair and is only a short distance from the stout, posteriorly directed submarginal bristle. Wings and halteres absent.

Abdomen swollen, largely membranous, elliptical in form. Six terga sclerotized, the sixth very feebly so, protruding only slightly from beneath the fifth tergum. First tergum about one-half as long as the thorax. The relative lengths of the first five terga as follows: 2:7:5:4:5; the relative widths: 12:17:16:15:10. No gland opening is apparent in the fifth tergum, although there is a transverse impression at the base. Terga rather sparsely setose; membranous parts of segments three to six with scattered setae set in minute, chitinous rings.

Legs similar to those of *reichenspergeri* except that there are only five transverse, comb-like rows of setae on the hind metatarsus.

Measurement.—Length 1 mm.

Homalophora metae sp. nov.

Type from Villavicencio, Colombia. In the collection of Field Museum of Natural History. A female. Collected July 19, 1938, by Charles H. Seevers.

Host.—Nasutitermes (*N.*) *ephratae* Holmgren. Determined by Alfred E. Emerson.

Description.—Head and notum light brown, notum lighter medially, abdominal sclera darker brown. Under parts of head and thorax testaceous, membranous parts of abdomen grayish brown.

Head longer than broad. Eyes elliptical, larger than the third segment of the antennae. Ocelli rather large. Head bearing four postantennal bristles which are nearly equal in length, the posterior pair being farther apart than the anterior ones, two preocular bristles, and four setae along the occipital border. The inner pair of this occipital row is between the posterior ocelli while the outer two are close to the posterior angles of the head. Palpi bearing five moderately stout bristles and some finer ones.

The notum twice as wide as long; the posterior border with a row of six strong setae. The middle bristle on each side midway between the inner and outer bristles, and half as far from the inner bristle as the distance between the median pair. Wings absent.

Abdomen swollen, elliptical in form, largely membranous. Six terga are sclerotized in part, their relative widths approximately as follows: 10:13:12:9:4.5:2.5; the relative lengths: 2:6:4:4:2:1.5. The fifth tergum is about one-third as wide and as long as the second, and is without a gland opening. Terga clothed with short hairs but without prominent setae. Membranous parts of third to sixth abdominal segments bearing scattered setae set in small, chitinous rings.

Legs similar to those of *reichenspergeri* except that the hind metatarsus is not more than one-half as long as the hind tibia and bears only four and one-half transverse rows of setae.

Measurement.—Length 0.9 mm.

Remarks.—Two species of *Homalophora* have been described: *H. reichenspergeri* Borgmeier (1923, p. 178) was collected from a colony of *Cornitermes* sp. in Brazil and *H. cubensis* Brues (1932, p. 141) was taken with *Atta insularis* Guerin in Cuba.

H. metae differs from the other three species in the size of the sclerotized areas of the fifth and sixth terga; the fifth is relatively small, for it is only one-third as wide and long as the second tergum, while the sixth is relatively large, since it is more than one-half as large as the fifth. The sclerotized area of the sixth tergum of the other species is scarcely perceptible. *H. metae* and *guatiquiae* have only four setae in the occipital row; *reichenspergeri* and *cubensis* have six. All the species have six setae on the notum; the outermost one on each side is just caudad to the middle and very near the lateral border while the other four setae vary in their positions along the posterior border. In *reichenspergeri*, the more lateral of the middle four setae is approximately as far from the inner setae as the distance between the median pair; in *cubensis*, the lateral setae are one-half as far from the inner setae as the distance between the median pair, and are also one-half as far from the median setae as from the lateral border; in *metae*, the lateral setae are also one-half as far from the inner setae as the distance between the median pair, but the lateral setae are about equidistant from the median setae and the lateral border; in *guatiquiae*, the lateral setae are twice as far from the inner setae as the distance between them, and are quite close to the lateral border.

The two new species do not have the wing rudiments which are present in *reichenspergeri*, nor do they have propleural setae. The ocelli of the new species are apparently larger than in *reichenspergeri*. The hind metatarsus of *reichenspergeri* bears seven transverse combs of setae; both new species have five or less rows.

Puliciphora (Puliciphora) termitophila sp. nov.

Type from Barro Colorado Island, Canal Zone. In the collection of Field Museum of Natural History. A female. Collected August 19, 1935, by Alfred E. Emerson.

Paratype.—A female, same data as the type, in the collection of Charles H. Seevers.

Host.—*Nasutitermes* (*N.*) *ephratae* Holmgren. Determined by Alfred E. Emerson.

Description.—Dorsum of head dark brown; the posterior corners lateral to the ocelli and an oval area on either side of the median line anterior to the ocelli lighter in color. Thorax and legs yellow, the dorsum of thorax light brown. Abdominal terga dark brown, the membranous areas of abdomen gray except for the brown elliptical rings about the setigerous punctures.

Head slightly broader than long, sides subparallel, posterior border straight, anterior border slightly arcuate. Three ocelli present. Macrochaetae arranged on the head as follows: Five on the outer surface of the palpi; four postantennals near the anterior border of the front; two rather weak preocellar setae; two stout setae between the posterior ocelli; one seta medial to each eye and closer to the eye than to the median line; three preocular setae; and two near the posterior corner of the head on each side. Head rather densely clothed with many fine hairs.

Antennae three-segmented; the large third segment globose; the plumose arista about three times as long as the third segment. Eyes moderate in size, with about forty facets, pilose.

Thorax slightly less than twice as broad as long. Thorax bearing eight setae arranged as follows: A pair of rather weak propleural setae; two bristles at the site usually occupied by the wings; two setae at the side borders of the mesonotum and a pair on the posterior border. Thorax finely pilose except for the nearly glabrous sides. Notum rounded in profile, rather weakly sclerotized except for a rather narrow discal area. Pleura weakly developed, the segments distinguishable, however. Wings absent.

Abdomen strongly inflated, twice as wide, at greatest diameter, as the thorax. Abdomen membranous except for sclerotized areas of six terga; the first tergum very short and the sixth reduced to a small lunule. The relative lengths of the terga are as follows: 1:10:6:6:4:2; the relative widths: 7:9:9:8:5:2. The fifth tergum with a long, crescentic slit, which is, presumably, the opening into a glandular sac beneath. Abdominal segments posterior to the sixth much narrower, telescoped in the specimens examined, the terminal segment bearing a pair of foliate flaps. Terga with a number of recumbent hairs, the posterior border of each bearing longer setae (the second with eighteen or nineteen, the third with from fifteen to seventeen, the fourth with from twelve to thirteen, and the fifth with from nine to eleven). The membranous parts of the abdomen bear short setae arising from setigerous punctures enclosed by elliptical chitinous rings; the sides of the first four segments are glabrous. Sixth and seventh segments encircled by terminal rows of macrochaetae.

Legs rather long, uniformly pubescent throughout. Tibiae with an apical spur. Tarsi elongated, longer than tibiae. Tarsi five-segmented; hind metatarsus about as long as three following segments and bearing six transverse rows of bristles on the plantar surface.

Measurement.—Length 1 mm.

Remarks.—As indicated earlier in the paper, the genus *Puliciphora* is comprised of many species which are distributed through most of the tropical areas of the world. No attempt will be made here to cite references to all the species or to differentiate the new species from any except the most closely related forms. Only five other species of the genus have been associated with termites and *termitophila* is not very closely related to any of them. The other termitophilous species are *P. anceps* Schmitz (India), *P. velocipes* Schmitz (India), *P. termitum* Schmitz (India), *P. spinicollis* Schmitz (Belgian Congo), and *P. bicolor* Borgmeier and Schmitz (Brazil).

P. termitophila is apparently most closely allied to *P. ossuaria* Schmitz (1929, p. 160), of Brazil, and *P. borinquenensis* Wheeler (1906, p. 269), from the West Indies and Central America. It differs from both in the chaetotaxy of the head and terga, and from the latter in the chaetotaxy of the thorax. *P. occidentalis* Melander and Brues (1903, p. 17), which is known from Massachusetts and the Bahama Islands, does not have the sixth tergum sclerotized, and differs in the chaetotaxy. Other New World species (*P. bicolor* Borgmeier and Schmitz, *P. venata* Aldrich, *P. myrmecophila* Brues, *P. nitida* Malloch, *P. glacialis* Malloch and *P. incerta* Silvestri) belong to other subgenera (Schmitz, 1929).

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